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CHEMICAL BIOLOGICAL CENTER
U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND

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HAZARDOUS WASTE REMOVAL OPERATIONS CONDUCTED IN SUPPORT OF THE BZ AGENT/MUNITIONS DISPOSAL FACILITY REMEDIATION PROJECT

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14. ABSTRACT
The U.S. Army Edgewood Chemical Biological Center (ECBC) with URS Corporation was tasked with identifying, removing, and disposing of hazardous materials from a former BZ Agent/Munitions Disposal Facility (BZDF) located at Pine Bluff Arsenal (PBA), Pine Bluff, AR, prior to mass demolition of the facility. This project required ECBC to provide the necessary technical expertise, labor, and equipment to support site mobilization/setup; to survey, sample, and analyze all suspected hazardous materials; remove all hazardous materials from the BZDF; dismantle the interior and exterior of BZDF contaminated equipment as required to remove the hazardous material/waste; conduct final sampling and analysis to indicate the equipment/area is clear of hazardous materials/waste to acceptable levels; package all materials/waste according to regulatory requirements; ship waste, debris, and recyclable materials to a disposal facility or recycler; and demobilize the site upon completion. ECBC completed these tasks, and all remediated BZDF areas and equipment were determined clear of hazardous materials/waste to acceptable levels by the Washington Demilitarization Company and ECBC prior to demobilization. All materials/waste removed from the BZDF were characterized, segregated, packaged, transported, and disposed of in accordance with approved procedures and regulatory requirements.

15. SUBJECT TERMS

BZ Agent/Munitions Disposal Facility (BZDF)
Washington Demilitarization Company (WDC)
Cooperative Research and Development Agreement (CRADA)
Waste Management
URS
Hazardous Waste Removal
Metal Parts Furnace (MPF)
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PREFACE

The work described in this report was authorized under CRADA Agreement No. 0716C, Task No. 001. The work was started in June 2009 and completed in December 2009.

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HAZARDOUS WASTE REMOVAL OPERATIONS CONDUCTED IN SUPPORT OF THE BZ AGENT/MUNITIONS DISPOSAL FACILITY REMEDIATION PROJECT

1. GENERAL COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT SCOPE

On July 6, 2009, the U.S. Army Edgewood Chemical Biological Center (ECBC) and Washington Demilitarization Company (WDC) International signed Cooperative Research and Development Agreement (CRADA) # 0716C, Task Order 001. Under this CRADA, ECBC was tasked to provide technical expertise, labor, and the support necessary to mobilize equipment; survey, and sample all suspected hazardous materials; remove all hazardous materials from the BZ Agent/Munitions Disposal Facility (BZDF); dismantle the interior and exterior BZDF contaminated equipment as required to remove the hazardous waste; decontaminate the building and equipment as needed; conduct final sampling as necessary; package all waste according to WDC and regulatory requirements; ship wastes, debris, and recyclable materials to WDC approved disposal facility or recycler; and demobilize upon completion of all operational tasks.

2. BACKGROUND

The BZDF (Figure 1) was constructed for the safe disposal of a munitions stockpile containing 3-quinuclidinyl benzilate (BZ). The BZDF operated for approximately 18 months and ceased agent destruction operations in 1990. The BZDF was Resource Conservation and Recovery Act (RCRA) clean closed by the Pine Bluff Arsenal (PBA) as determined by the Arkansas Department Pollution Control and Ecology (ADPC&E) (now referred to as the Arkansas Department of Environmental Quality [ADEQ]) Hazardous Waste Division on August 20, 1990. The BZDF destroyed BZ in the form of munitions, powdered agent in drums, and liquid agent in drums. These different forms of BZ were demilitarized by separate processes during operations. Munitions were processed by means of an autoclave that was used to inert the BZ fill and explosives. These munitions were then sent to a Deactivation Furnace System (DFS), where the munitions were heated to 1,000 °F for a specified period of time. The residues from this operation were processed through the Heated Discharge Conveyor (HDC).

BZ liquid drums were processed in Metal Parts Furnace (MPF) #1 and #2. The liquids were evaporated in the furnaces and the vapors were combusted in the primary fume burners above the furnaces to destroy the BZ. MPF #3 and #4 were used to destroy the materials and secondary wastes from unpacking munitions and contaminated materials from BZ processing. A Common Afterburner (AFB) and Pollution Control System (PCS) handled the combustion gases from all six BZDF incinerators. Drums containing BZ agent in the form of powder were processed through the Liquid Incinerator (LIN). The powder was mixed into slurry with acetic acid and pumped into the incinerator, where the BZ was destroyed.

Figure 1. BZDF Facility

The BZDF was monitored for BZ agent through randomized wipe samples to achieve the aforementioned 1990 RCRA clean closure status. As part of the closure process, items that were identified as being contaminated were subsequently decontaminated and re-sampled. Materials that could not be decontaminated were fed to the MPFs for incineration. These materials included piping, glove boxes, and dismantled liquid tanks. The BZDF remained inactive in a cold and dark state after RCRA closure.

3. HAZARDOUS MATERIALS/WASTE WITHIN THE BZDF

Hazardous materials known or suspected to be present in the BZDF included batteries, light bulbs and ballast, refractory, liquids, and mercury thermostats. All identified hazardous materials and all liquids were subsequently removed from the BZDF. Any tiles that tested positive for asbestos were removed. Any smoke alarms/ detectors containing americium were removed. Electronic equipment such as computer monitors from the Control Room was removed. All material was containerized and labeled as required for proper storage, transport, and disposal.

All interior process and support equipment including the DFS, MPF material handling equipment in the MPF Room, LIN, generator, air compressors, liquid tanks, and air handling units, etc., remained in place and was disassembled or removed. This was done as required to drain/remove hazardous materials including all lubricants, coolants, refrigerant, and such from gear boxes, compressors, equipment, and motors, etc.

The Common AFB, exterior to Building 57-110 (which housed the furnaces), was disassembled as necessary to remove all refractory and ash that had Toxic Characteristic Leachate Procedure (TCLP) metals above the regulatory thresholds. The Pollution Control System (PCS) and associated ducting was also cleared of all material including ash, rust scaling and debris that exhibited TCLP metals concentrations above regulatory limits.

4. WASTE MANAGEMENT

Wastes generated during the BZDF Remediation Project were managed in accordance with the ECBC BZDF Waste Management Plan. The goal of the plan was to ensure that materials designated as waste were properly characterized, placed into the appropriate storage containers, clearly identified, maintained, and disposed of in full compliance with all state and federal regulations for waste (non-hazardous, universal, and hazardous) management.

The process of waste management started with the proper characterization of materials generated as part of the remediation process. Operational areas were sampled to determine the components of the potential waste streams. The samples were analyzed using Environmental Protection Agency (EPA) Method 1311 (TCLP) to determine whether or not the components of the waste meet the RCRA requirements in accordance with 40 Code of Federal Regulations (CFR) Section (§) 261.24.

For operational purposes, the sampling produced a refractory brick, slag, and/or ash waste consisting of cadmium (RCRA waste code D006), chromium (RCRA waste code D007), and lead (D008) above the concentration thresholds identified in 40 CFR §261.24. These were the expected waste constituents to be found in the processing components (incinerators) of the BZDF. These areas included the Common AFB, DFS, HDC, MPF, and the PCS. Each area was sampled individually to ensure that the waste streams did not contain other metals above the RCRA TCLP regulatory limits.

This refractory brick, slag, and/or ash waste was removed by ECBC during remediation operations and placed into lined roll-off containers (Figure 2) that were labeled in accordance with the management practices listed in the ECBC BZDF Waste Management Plan. The accumulation start date began with the day that waste material was first placed into the container; although waste material was continually added until the container was full. The area was inspected daily and documented on the ECBC 90-Day Hazardous Waste Area Inspection Form. A total of three roll-off containers were used to contain the waste generated from the removal of material from the remediation of the BZDF furnaces, Common AFB, PCS, and associated ducting.

Figure 2. Hazardous Waste Disposal Roll-off Containers

During the waste removal process, other materials such as used motor oil, compressor fluid, used coolant, fluorescent light ballasts, capacitors, and water contaminated with oily sludge were removed. These materials were identified using generator knowledge and Material Safety Data Sheets (MSDS) to categorize and appropriately designate the substances as Non-RCRA regulated waste. These materials were placed into the proper storage containers, labeled, and managed accordingly. These wastes were stored and managed in the appropriate < 90 day hazardous waste storage areas designed by URS. When necessary, samples were taken from these materials to ensure that the waste did not contain any RCRA listed waste or polychlorinated biphenyls (PCBs) of the Toxic Substances Control Act (TSCA) at or above the limit of 50 parts per million (ppm).

Universal wastes were generated as part of the remediation process at the BZDF. Fluorescent light bulbs, lead acid batteries, nickel cadmium batteries, and mercury ampoules from vacuum gauges were collected throughout the BZDF. These materials were properly identified, labeled, and managed in <90 day hazardous waste storage areas designed by URS (Figure 3). Leaking batteries and broken fluorescent bulbs were labeled as hazardous waste and managed accordingly.

Figure 3. Hazardous Waste Segregation

Asbestos containing material (Category I non-friable) was identified in floor tiles in the Toxie Change Area and Control Room. This material was removed, placed into the proper storage containers, and managed in < 90 day hazardous waste storage areas designated by URS. This material was regulated under TSCA and labeled as Non-RCRA regulated waste.

Throughout the process of generating waste at the BZDF, routine periodic inspections were performed in accordance with the frequency detailed in the ECBC BZDF Waste Management Plan. The inspection forms were maintained onsite and made available to URS personnel and PBCDF onsite ADEQ Hazardous Waste Division inspectors upon request. The waste inventory log was updated daily and was available to URS personnel and PBCDF onsite ADEQ Hazardous Waste inspectors upon request. The inventory log was also stored electronically and made available to all concerned parties on a daily basis.

Good housekeeping practices were followed, as seen in Figure 4, to ensure the waste storage areas were easily accessible and unobstructed so that activities could be conducted safely. Containers were clearly labeled, the contents easily identified, and minimum aisle space was maintained to ensure wastes were stored correctly. All applicable waste storage regulations were followed to ensure that the areas met the

requirements in the ECBC BZDF Waste Management Plan, PBCDF waste management expectations, and all state and federal regulations.

Figure 4. <90 Day Hazardous Waste Storage Site

5. SITE SAMPLING

Prior to commencing the sampling and remediation processes, key areas were identified as being the principle areas of concern for the presence of hazardous materials/waste. These locations were the main areas involved in the demilitarization of the BZ materials. These locations were the DFS, LIN, Common AFB, all four MPFs, HDC, and the PCS. These areas were specifically identified for RCRA TCLP, PCBs, lead, and asbestos sampling.

Sampling was an ongoing process during the removal of hazardous materials and waste at the BZDF. The initial phase involved the collection of samples from the areas of concern for an initial characterization for the BZDF. During characterization, representative grab samples were collected from each area to determine if the area would require remediation or further sampling to determine whether or not the components of the area would be disposed of as hazardous waste.

5.1 TCLP Sampling.

In areas where the initial samples were below the TCLP regulatory threshold limits for toxie metals, no further sampling was eondueted. Areas that were above the limit(s) and eould be remediated were re-sampled after cleanup aetivities to eonfirm that the loeation was below the TCLP regulatory levels for toxic metals. If the elean-up samples were above the TCLP regulatory thresholds, then remediation aetivities eontinued until aceeptable levels were aehieved. Areas that were above the TCLP regulatory limits that eould not be remediated were re-sampled using a eomposite sampling teehnique. Whereas the grab sample represented the surfaee of the sampling area (and presumably where eontamination was loeated), the eomposite sample represented the full-thiekness of the material in its entirety. This type of sampling was performed to determine if the material eould be disposed of as non-hazardous waste. The BZDF Remediation Project Final Sampling Report eontains specific TCLP sample/analysis information. Samples colleeted ineluded solid sample media in the form of refraetory briek, ash, and metal debris. Whenever possible, liquid samples were collected as part of the post remediation re-sampling. Solid samples were obtained from areas where liquid samples were neither feasible nor possible to determine the effieaey of the remediation.

5.2 PCB Sampling.

PCB sampling was conducted as suspect materials were identified.

5.3 Asbestos Sampling.

During the period of September 15-30, 2009, approximately 137 asbestos samples were obtained from suspeeted materials at the BZDF. The sampling area covered 28,000 ft^2 to inelude suspeeted materials on equipment inside and outside the BZ Building (Building 57-110). Of the total number of samples obtained, seven samples were identified as asbestos eontaining matcrial (ACM). This material was elassified as Class 1 non-friable pursuant to 40 CFR §61.141. Further discussion of the aforementioned asbestos survey performed by ECBC is eontained in the BZDF Asbestos Survey of Building 57-110 report.

5.4 Lead Paint Sampling.

On September 23, 2009, lead paint ehip samples were obtained from the interior (walls, flooring, and other painted surfaces) of the BZ Building (Building 57-110) and analyzed using EPA Method 6010C for total metals. The purpose of this sampling was to identify lead based paint surfaees inside the faeility to proteet workers who were performing remediation activities. Sampling for lead paint was considered for industrial hygiene purposes only and not in determining the waste stream of the building demolition debris. Approximately 23 samples were obtained throughout the main areas of the building. The areas sampled included the LIN, Common AFB, DFS, HDC, laundry areas, Munitions Inerting Area (MIN), Munitions Unpack Area (MUA), decontamination areas, Control Room, and mask fit/personal proteetive equipment (PPE) issue areas. Other areas

were not included because the paint was very similar to areas previously sampled. Every effort was made during this sampling effort to include the various paint types used throughout the building interior. Of the 23 samples collected, approximately 21 were identified as containing lead. Further discussions concerning the lead based paint sampling effort and subsequent results are available in the BZDF Lead Based Paint Survey. The areas containing lead paint were disposed of in conjunction with the other materials during the mass demolition of the BZ Building (Building 57-110).

6. SITE SAFETY

During the execution of this project, ECBC made safety a primary focus of day-to-day activities. Safety was an integral part of the overall success of the project. ECBC developed a BZDF Safety, Health, and Emergency Response Plan (SHERP) prior to the start of the project. This document was followed throughout the project.

For day-to-day operations, ECBC performed activities such as a morning safety briefing, which discussed potential safety concerns for the day, as well as highlighted previous safety concerns. During the daily safety briefing potential hazards were discussed by the crew, Safety and Health Officer (SHO), and the Team Chief. An overall Standing Operating Procedure (SOP) for waste removal operations was developed prior to the start of the hazardous materials and waste removal operations. Within the SOP, a hazard analysis was written to discuss and mitigate potential safety concerns associated with waste removal operations. Also, task specific Job Safety Analysis (JSA) was developed for specific removal operations. Prior to the start of hazardous material and waste removal operations all assigned personnel were required to read and sign off on the SOP. JSAs were also discussed before a specific operation was started and personnel performed a safety walkthrough of the operation prior to actually conducting it.

The SHO and Team Chief prepared sampling and monitoring equipment as required and conducted assessments of confined spaces prior to any entry. A daily walk around assessment was conducted by the SHO and Team Chief to identify and mark hazards prior to work beginning. Any new issues identified would be incorporated into a JSA and briefed to those involved. ECBC also performed inspections which included the specific days work site, general site, equipment, tools, and materials. Known hazards such as noise, poor lighting, tripping, and slipping were addressed and abated through normal protocols such as signage, cordons, or illumination. ECBC verified daily that work area conditions were suitable and that no failures of systems such as High Efficiency Particulate Air (HEPA) filters or containment systems were degraded allowing an excursion of asbestos or contaminated refractory.

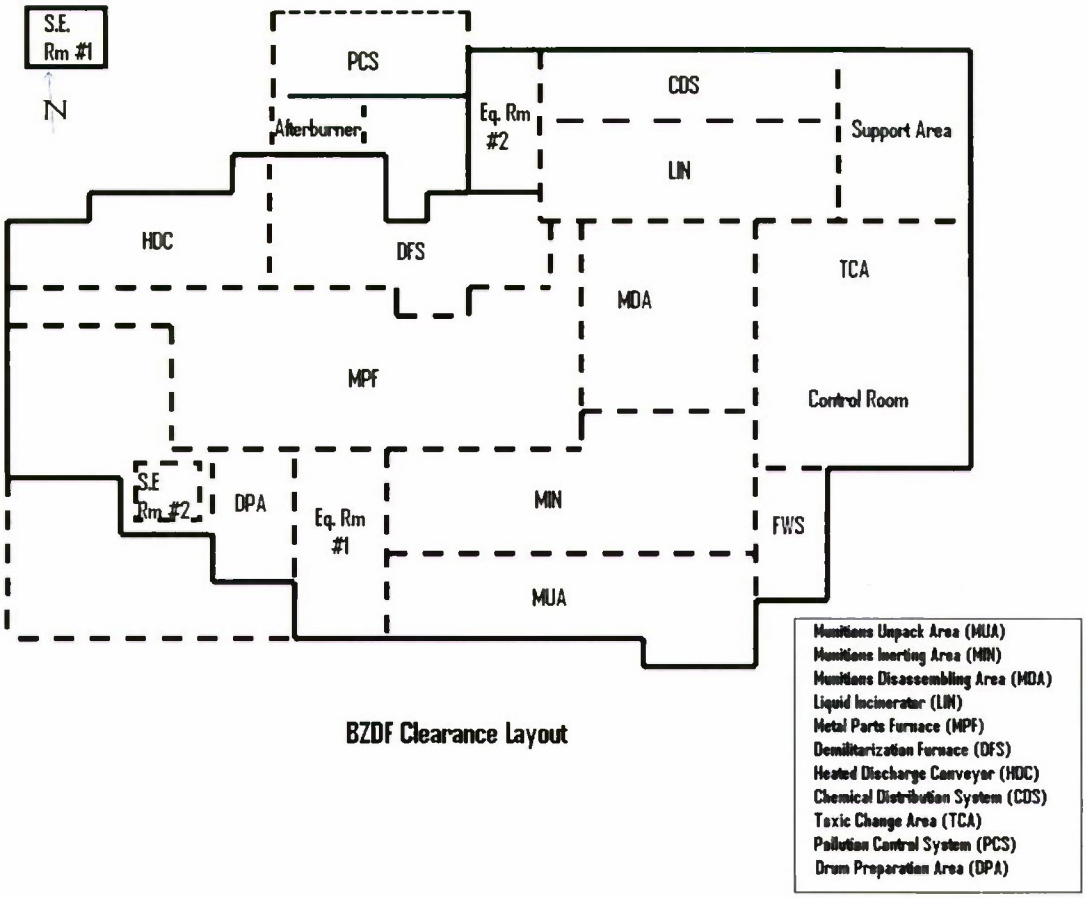
7. HAZARDOUS MATERIALS AND WASTE REMOVAL APPROACH/ REMOVAL PROCESS

Prior to waste removal operations in Building 57-110, an initial walk through was performed to identify areas of concern and to divide the building into specific areas/sections for removal operations and clearance purposes.

An overall SOP (Removal of Hazardous Waste Materials Required for Building Demolition [SOP # CNG-138PB]) for hazardous materials and waste removal operations was developed and subsequently followed during remediation efforts. Task specific JSAs were also developed for specific removal operations. Prior to the start of hazardous materials and waste removal operations, all assigned personnel read and signed off on the SOP. JSAs were also discussed before a specific operation was started, and personnel performed a safety walkthrough of the operation prior to actually conducting it.

Specific BZDF areas for potential remediation were identified as the Drum Preparation Area, Equipment Room #1, MDA, MUA, MIN, Fire Water System, Toxic Change Area, MPF, HDC, DFS, Common AFB, LIN, Chemical Distribution System, Support Area, Control Room, BZDF Roof, Sample Enclosure 1, Sample Enclosure 2, and PCS (including associated ducting, Figure 5). See Figure 6 for the layout of Building 57-110.

Figure 5. Hazard Waste Remediation of Pollution Control System Ducting



BZDF Clearance Layout

Figure 6. Building 57-110 Layout

7.1 Universal Waste.

A survey team composed of ECBC personnel performed inspections of each area/section within the BZDF identifying all universal waste to be removed (i.e., lights, ballasts, electrical components, etc.). Remediation was achieved by physically removing the items from the BZDF, segregating like items, and packaging them for proper transportations to offsite facilities. Removal operations were completed by section to ensure the safety of all site personnel and to better inventory and manage the items that were removed. After remediation was completed, a visual inspection of each section was performed by ECBC and URS. The inspection was documented and signed off on by both parties to finalize remediation activities for universal waste within each specific area of the BZDF.

The approximate quantities of universal waste removed from the BZDF are as follows:

- 71 batteries

- 275 fluoreseent light tubes
- 6 mereury switehes
- 140 lb of refrigerant
- 363 light bulbs
- 3 bins of used eleetronie boards

7.2 Asbestos.

Prior to removing ACM from the BZDF, an aeeredited EPA Asbestos Hazard Emergency Response Aet (AHERA) inspeetor, employed by ECBC, performed an initial walkthrough of the faeility to beeome oriented with the building layout. A follow-up survey was eondueted area by area to inelude hallways, restrooms, meehanieal rooms, ete. to identify eaeh homogeneous area. A homogeneous area eontains suspeeted ACM that is uniform in texture and eolor and appears identieal in every other aspeet. During the visual inspeetion, the inspeetor reeorded, doeumented, and visually identified all building materials sueh as plaster, einder bloek, eonerete, tiles, and earpeting. Onee the survey was eompleted, approximately 137 samples were taken for asbestos analyses. When ACM items were identified, ECBC and WDC diseussed safe and eompliant paths forward for remediation. In many eases, it was determined that the amount of material was insuffieient for remediation aetions and safer to leave in plaee exeept for loose building tile with mastie, whieh eontained Class I non-friable ACM, in the TCA and Control Room that were removed, containerized, and disposed in the PBA '86 Landfill.

Approximate quantities of asbestos removed from the BZDF were 13 drums of loose floor tile with mastic eontaining Class I non-friable ACM.

7.3 Hazardous Waste.

A survey team performed inspections of eaeh designated seetion of the BZDF identifying all suspeeted hazardous waste to be removed (i.e., mereury gauges, lead components, leaking batteries, smoke deteetors, ash, refraetory, petroleum produets, ete.). Areas that were suspeeted for heavy metals were sampled and analyzed to determine eontamination levels. The sampling results ean be found in the BZDF Remediation Projeet Final Sampling Report. Remediation was aehieved by physieally removing the items of eoneern (Figure 7). Removal operations eonsisted of demolition of equipment, vaeuuming debris (Figure 8), and/or draining or pumping out hazardous liquids. All operations were completed by seetion to ensure the safety of all remediation personnel. In areas that were eontaminated with heavy metals, post remediation samples were eolleeted to eonfirm elearanee below EPA TCLP thresholds. If levels were found to be above EPA standards, then ECBC eontinued remediation work of the equipment and/or area in suspeet. After post remediation sampling was eompleted in eaeh seetion, a review of sampling results and visual inspeetion were performed by ECBC and WDC. The inspeetion was doeumented and signed off on by both parties to finalize remediation aetivities for hazardous waste.

Figure 7. Contaminated Refractory Removal

Before After

Figure 8. Pictures of Metal Parts Furnace Remediation

Approximate quantities of hazardous waste removed from the BZDF are as follows:

- 212 light ballasts
- 121 capacitors
- 290 gal of spent/used petroleum products
- 330 gal of coolant
- 4 gal of expired bleach
- 2,650 gal of oil/water
- six 55 gal drums of ash containing heavy metals
- 60 cubic yards of refractory contaminated with heavy metals

7.4 Lead Hazard.

Sampling for lead paint was considered for industrial hygiene purposes only. The areas sampled include the laundry areas, munitions inerting area, MUA, decontamination areas, Control Room, and mask fit/PPE issue areas. Sample results can be found in the BZDF Lead Based Paint Survey. It was determined from the lead paint survey that lead was present in Building 57-110, but it did not pose a dust hazard from the painted surfaces. The areas containing lead paint were disposed of in conjunction with the other materials in the BZDF mass demolition.

8. WASTE DISPOSAL

Waste disposal was conducted in accordance with the ECBC BZDF Waste Management Plan. PIKA International was subcontracted by ECBC to prepare shipping documentation and provide transportation of the containerized RCRA hazardous and RCRA non-regulated wastes to the designed treatment, storage, and disposal facilities (TSDF). This documentation included the generation of waste profiles, waste shipping manifests, Land Disposal Restriction forms, and providing the Certificates of Disposal. PIKA personnel also prepared the waste containers by applying the appropriate Department of Transportation (DOT) labels to the containers for transit to TSDF.

The roll-off boxes used to contain the ash, brick, and slag from remediation activities were removed from the BZDF on November 11, 2008. This material was transported to Clean Harbors Lone Mountain Facility in Waynoka, OK. The material was removed from the roll-off containers, where it was prepared for macro encapsulation at Clean Harbors Landfill. A Certificate of Disposal was generated and provided to ECBC on December 2, 2009.

Approximately 85 drums were picked up by PIKA International on December 2, 2009. This shipment consisted of RCRA, universal, and Non-RCRA regulated wastes from the BZDF remediation process. Wastes shipped included used motor oil, compressor fluid, coolant, capacitors and ballasts, mercury vapor bulbs, leaking

batteries, and recovered ionizing smoke detectors. The drums were delivered to Clean Harbors TSDF in El Dorado, AR, for disposal. The Certificate of Disposal was generated and provided to ECBC on December 16, 2009.

The smoke detectors containing americium were shipped to Environmental Management and Controls, Incorporated (Turlock, CA), for recycling.

Universal wastes were disposed through the PBA Materials Management and Environmental Affairs Office. PBA took custody of universal wastes for transfer to a recycling and recovery center. These universal wastes included lead acid batteries, nickel cadmium batteries, fluorescent light bulbs, and mercury ampoules from vacuum gauges. A signed Chain of Custody was provided to ECBC from PBA. ACM was transferred to the PBA for placement into the Non-RCRA landfill located at the Arsenal. A signed chain of custody was provided to ECBC from PBA.

All documentation (waste profiles, waste shipping manifests, Land Disposal Restriction forms, Certificates of Disposal, and Chain of Custodies) relating to the aforementioned waste shipments were provided by ECBC to URS.

9. CONCLUSION

The scope of this project as identified within the Cooperative Research and Development Agreement (CRADA) #0716C, Task Order 001 was to identify and remove all hazardous materials/wastes (including but not limited to potential asbestos containing material, fluorescent light tubes/ballasts, batteries, liquids, lubricants, refrigerants, antifreezes, fuels, refractory brick, mercury switches, americium in smoke alarms, and hydraulic oils) as well as dissemble contaminated equipment (if necessary) prior to the mass demolition of the BZ Agent/Munitions Disposal Facility (BZDF). The U.S. Army Edgewood Chemical Biological Center (ECBC) was successful in identifying, removing, and disposing of all known hazardous materials/wastes from the BZDF as described in the subject CRADA. All tasks were completed in a safe manner. All suspected materials/waste was disposed of in compliance with all local, state, and federal requirements. ECBC completed their tasks in an acceptable time frame and within Washington Demilitarization Company's overall project schedule for the mass destruction of the BZDF.